Field Tests of the Mars Oxidant Instrument (MOI) A. P. Zent, NASA Ames Research Center, R. C. Quinn, SETI Institute, F. G. Grunthaner, Jet Propulsion Lab, P. Ehrenfreund, Leiden Observatory

An implementation of the Mars Oxidant Instrument (MOI) was field tested at the Yungay Field Station (24°S), in arid core of the Atacama Desert, Chile, during February, 2004

Gonzalez-Navarro et al. (2003) demonstrated that the quantity and diversity of bacteria increase as a function of local water availability in the Atacama and that for some soil samples from the Yungay region, no bacteria could be isolated. Flash pyrolysis GCMS analysis of soils collected from these regions revealed extremely low levels of organic matter. The existence of organic-depleted, near-sterile soil offers an interesting Earth analog of the Martian surface material.

The Mars Oxidant Instrument, in the configuration tested here, records the DC resistivity of thin test-films exposed to the environment. MOI deployed identical film sets in configurations that permitted exposure to a) UV, b) dust, c) both (unfiltered) and d) neither. It was deployed to assess the chemical processes occurring in the environment.

Distinct reaction patterns are observed for each of three different Au-film sensor deployment modes. Reactivity is highest and reaction kinetics are fastest for sensors exposed to atmospheric dust. For the UV+Dust sensors, reaction proceeds after a twenty four hour dust accumulation period and an increase in atmospheric humidity at night. The observed response is consistent with dry-acid (H_2SO_4 and HCl) deposition on the sensors. Atmospheric sensors shielded from dust did not exhibit this response. Sensors exposed to soil displayed slower reaction kinetics due to buffering of humidity by the soil.

Non-aqueous pH measurements of the surface crusts in the confirmed very low pH in the presence of trace H_2O (Quinn et al., In prep). Atmospheric R_H reached > 90% overnight, occasionally approaching unity. Thin H_2O films solvate H_2SO_4 and HCl, attacking both test organic compounds and the underlying Au conducting films.

The majority of dust in the vicinity is gypsum, and the composition of the acidic soil components is likely dominated by H_2SO_4. The use of the MOI sensors in different configurations modes, as demonstrated here, discriminates between oxidant reaction pathways and will allow rapid characterization of environmental chemical processes on Mars.

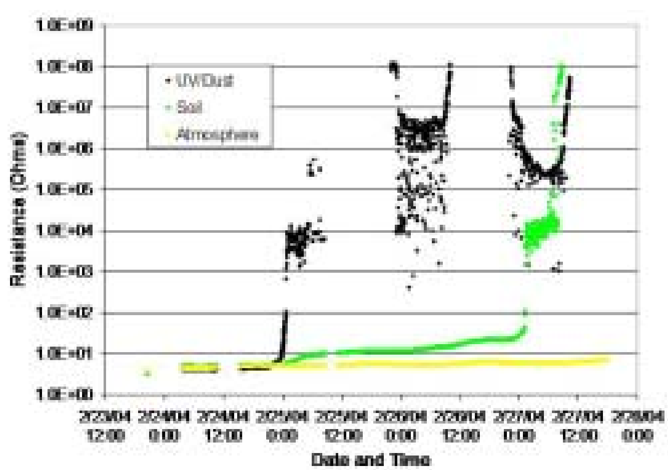

Figure 1. Resistance changes in thin-gold films as a function of time and deployment mode, Chemical modification of the films was induced by a combination of dust and water exposure. Films exposed only to the atmosphere remained essentially unchanged. In sensors exposed to soil or dust, chemical modification was triggered by solvation of acidic soil components due to changes in humidity.